

Controlling the Rust is a Must!

Detection of a Major Gene for Rust Resistance to Fusiform Rust Disease

VOCABULARY

Vocabulary marked in article in italics

Genes

Small sections of DNA which contain hereditary information

Genetic Code

Specific genes that are the same for forms of life

Offspring

The product or result of something or someone; like a child

Pathogen (path' oh jen)

An organism or other agent that causes disease

Pollen

Particles containing genetic material for reproduction of plants

Resistance

Able to withstand an effect

Spores

Microscopic bodies which alter germination and develop into fungi

Susceptible

Can easily be affected by something, such as disease

Technology

Mechanical improvements intended to aid human activities

Adapted from:

Kuhlman, George E., H. V. Amerson, and W. D. Pepper. 1997. Inoculum density and expression of major genes resistant to fusiform rust disease in loblolly pines. *Plant Disease*, 81:1-4.

Some scientists conduct **longitudinal** (lon' ja tude in ul) **research**. This is research that occurs over a long period of time. Some research may even take years to complete. The scientists in this study were interested in breeding trees that are resistant to disease. In order to understand how successful the research is, the scientist will have to do this study with successive generations of trees.

Discovery

In this experiment, you will purposely germinate pollen from a flower. Fill 3 cups with boiling water (BE CAREFUL!!). Add 1 teaspoon of sugar to the first cup, 2 teaspoons of sugar to the second cup, and 3 teaspoons to the third cup. Mix well to dissolve the sugar. Now pour a small amount from each solution into three separate saucers. With the help of your teacher, shake the pollen from different kinds of flowers onto the surfaces of the sugar solutions. Pollen comes from the stamens, which grow in a ring around the flower's center. Cover each saucer with a piece of glass and let them stand at room temperature for at least three hours. Examine the pollen grains with a magnifying glass (or on a microscope slide) to see whether tubes are growing from them. Which sugar solution produced the most germination?

Introduction

Fusiform Rust Disease is a disease that affects trees. Research on Fusiform Rust Disease has progressed over the years. *Technology* has become more advanced and many new studies are used to find out more about the disease. There is no treatment for infected trees, but a huge step is being taken to find out what makes a tree resistant to the disease. Scientists George E. Kuhlman, H. V. Amerson, and W. D. Pepper, have studied the disease for a very long time. They have not found a cure for the disease, but are working on finding the secret to *resistance*.

Reflection

- 1 What are the scientists trying to accomplish with their research?
- 2 What other types of genetic information do you think trees can inherit? What other types of genes do you think you inherit?



A fusiform rust gall on a branch.

Methods

Dr. Kuhlman and his colleagues used the *offspring* from loblolly pine trees to conduct their experiment. Some of the trees that they used were resistant to the disease as far back as three generations. The resistant loblolly pines were then bred with other pine trees that were *susceptible* to Fusiform Rust Disease. The susceptibility passes on to other trees through *pollen*, which contains genetic material that is passed on the seeds which eventually sprout into seedlings.

Pollen is usually transported to the other trees by wind, rain, or by simply falling off one tree to another. Dr. Kuhlman purposely cross-bred the trees to determine which *genes* played a major factor in the *resistance* of Fusiform Rust Disease. When humans control plant pollination, it is called selective breeding. Scientists use selective breeding in plants to grow larger tomatoes or sweeter watermelons, for example.

Dr. Kuhlman was able to look at the DNA of loblolly pine trees by removing it from seedlings that had just sprouted. DNA is responsible for carrying the *genes* which are inherited from parents. Dr. Kuhlman looked at the *genetic codes* in the cells taken out of the trees. The codes show whether the tree is resistant or not. This complicated research is done with the use of advanced *technology*.

Reflection

- 1 Why do you think the scientist tried breeding healthy trees with sick trees?
- 2 Why do you think the scientist is studying the genes rather than the symptoms of the disease?

Results

Dr. Kuhlman and his colleagues came up with some interesting results. They found that half of the tree's *offspring* were resistant to the disease. Dr. Kuhlman found that trees are resistant to the disease primarily because of one gene, even though other genes contributed to *resistance*. Dr. Kuhlman and other scientists had previously believed that *resistance* to the disease was caused by an equal combination of *genes*.

The scientists concluded that purposely breeding trees with a particular mixture of *genes*, and especially those with the primary *gene*, could produce healthier trees.



Reflection

- 1 Can you think of other ways that purposeful or selective breeding is used by scientists? What are selective breeding's advantages? It's disadvantages?
- 2 Do you think trees in natural forests have the same problems as trees in orchards? Why or why not?